DOCUMENT RESUME

ED 277 242 FL 016 199

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TITLE A "Hands-On" Approach to Teaching English for Science.
PUB DATE 83
NOTE 15p.; Paper presented at the Summer Meeting of the Teachers of English to Speakers of Other Languages (Toronto, Canada, July 1983).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Arabs; College Second Language Programs; College Students; Communicative Competence (Languages); Course Organization; *English (Second Language); *English for Science and Technology; *English for Special Purposes; *Experiential Learning; *Field Experience Programs; Higher Education; Program Development; Realia; *Sciences; Second Language Instruction; Second Language Learning
IDENTIFIERS Rhodes College TN

ABSTRACT

A college course in English as a second language for the sciences that combines field experience with language learning is outlined. The proposed course includes two components: (1) a core course of both relevant scientific content and language, including grammar, vocabulary, reading, and writing presented topically; and (2) visits to sites and laboratories where the language is used in a natural setting. The core course is oriented to the size and language level of the anticipated class and is offered in a traditional classroom environment. It stresses language functions and grammar useful for immmediate communicative needs and includes any special forms pertaining to the specialty field. Reading is taught even to beginners, and ideally, reading and writing assignments are linked to the on-site experience. Additional opportunities for comprehensible input include lectures, demonstrations, science laboratories, and other subject-area discourse phased into the course gradually. The successful use of the approach with a group of Saudi Arabian students is also described. (MSE)

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A "HANDS-ON" APPROACH TO TEACHING ENGLISH FOR SCIENCE

BY: Douglas Magrath
1986

Presented at the 1983 TESOL Summer Meeting

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A "HANDS-ON" APPROACH TO TEACHING ENGLISH FOR SCIENCE

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An effective English for Science and Technology (EST) program should be designed in such a way as to allow learners to have maximum exposure to both the target language and the target field, be it engineering, chemistry, biology or the like. Learners can benefit greatly from a functional program where they combine field experience with language learning. By visiting sites and laboratories where the language is used in an unforced natural setting, the students observe practical demonstrations and gain valuable "hands-on" experience in their field. This on site component combines easily with a core class of both content and language that includes grammar, vocabulary, reading and writing presented in a topical or "natural approach". The remainder of this discussion will address the implementation of such a program and the theoretical basis behind the approaches used.

INITIAL IMPLEMENTATION

First, the students' language level and specific field of interest must be determined. Lower level learners will need a larger core course component than higher level learners. Different scientific fields will require different content areas and different sorts of field trips and science laboratories. Unfortunately, program planners may not know the level of language proficiency until after the students arrive; thus they should be flexible in their

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plans allowing for a significant variation in language ability since course content may have to be revised once the students are tested. The ESL teaching staff should be familiar with the various approaches to ESL teching and they should be prepared to face a multi-level class. The books used in the core class need to be of a sort that can be used by learners of varying degrees of ability. Additionally, the teachers should be able to develop materials since the expected group of high intermediates may turn out to be low level beginners.

The "core course" then will be set up according to the estimated number and level of the student body. The planners should be prepared for a number larger or smaller than originally proposed. As start up time approaches, The planners should order books and materials keeping in mind that the language level of the group members will vary. The staff needs to decide on a format for evaluating and placing the students. A good instrument for general language ability would be the Michigan Test of English as a Second Language or the CELT (Georgetown) along with oral interviews and writing samples. Experience in traditional English skill areas, grammar, composition ,etc. should be considered along with experience in the target EST field. Obviously if the students have had experience in the technical field they are going to study, they will be able to understand the lectures and demonstrations better than or just as well as those with more language experience and no

training in the target field

The "on-site" or "hands-on" part of the course can be set up with the cooperation of science departments on campus and local industry. EST students can attend scheduled lectures, films and demonstrations as well as special lectures provided by science faculty and teaching assistants. Ideally, some of the science staff can be hired to team teach with the ESL instructors. For off campus visits, local companies will often be glad to conduct tours and explain technical processes to visiting students. These visits need to be set up well in advance and transportation arranged.

THE THEORY BEHIND THE APPROACH

So far we have discussed the initial set up phase of the various components. Why do we need a "core class" and a "hands-on" component? Is the "core class" just another ESL grammar class or is it something more. Is the "Natural Approach" (Krashen and Terrell, 1983) applicable to English for Specific Purposes programs ? In this section we will address these issues.

THE CORE CLASS

The proposed EST model starts with a core class of language and content material offered in a traditional classroom setting. Students learn language functions or grammar that is necessary for their immediate communicative needs in addition to any special forms pertaining to their

fields. Note Widdowson, "Hence the language content of the course is selected not because it is representative of what the learner will have to deal with after the course is over, but because it is likely to activate strategies for learning while the course is in progress." (Widdowson, 1981,5) The learning strategies will be most useful during the "on-site" component when students will to be able to understand authentic material that is outside of the official lesson plan. Thus the core course must include necessary communication strategies that will enable the learners to generate their own utterances in a variety of situations. Robinson (1980) comments, "The learner should, presumably, then, be equipped with the generative power to say what is outside the syllabus." (Robinson,27) In addition, students studying EST will need to function in this country while they are studing, and they will have to apply their classroom lessons to everyday practical problems of getting around town. Later they will need to use their skills in communicating with English speakers on and off the job site in whatever country they are working in.

The amount of "basic language" or grammar included in the core course depends obviously on the level of the students. More likely than not they will need some intensive instruction. Several suggestions will be offered here for presenting structure in a realistic way.

The instructor can take the target structure and vocabulary and rework the material into a short conversational dialogue that involves a future class activity, field trip or a basic living situation(for low level learners). Avoid a forced stilted dialogue wrapped around a specific grammar point. Feel free to use some structures or content material that may not have been actively taught yet; the learners will be able to comprehend the material in context. Apply the input hypothesis: "This hypothesis states simply that we acquire(not learn) language by understanding input that is a little bit beyond our current level of (acquired) competence." (Krashen and Terrell, 32) Do not be concerned if your lesson covers material,passives for example, that are not introduced until book two. The learners will hear passives almost immediately when they begin to study technical material in the core class or in the on-site component.

The instructor needs to teach the forms and help the learners bridge the gap to communicative function at the same time. Drills and pattern practices should be used sparingly or not at all; students need realistic material; in EST this factor is doubly important since the learners will be using the target language as a tool for understanding of a content area. Mere drills are not sufficient: "The advocates of pattern drill give their students much practice in how to say things divorcing this practice from content, and paying little attention to what

is actually being said."(Diller,1978,69) For example, passives are often taught through a series of transformations. A better way would be for the students to use this construction to generate their own material in the content area by describing a scientific or mechanical process. An activity such as writing a lab report can include the "target structure". For example:

Step 1	Screws placed into position
Step 2	Wires connected red to orange
Step 3	Resistors placed by number
Step 4	Power supply adjusted
Step 5	.....

Now write out the lab report:

First the screws are placed into position on the board. Next the wires are connected .....etc.
(All examples do not need to be in the passive)

This type of problem solving exercise focuses on a real language function that the students encounter in the science lab. Variations are possible invoving not only the technical aspects of the course but also daily activities, where structure is blended to communicative need. Note what Krashen and Terrell have to say about language acquisition:

"According to the input hypothesis, language acquisition can only take place when a message which is being transmitted is understood,i.e.when the focus is on what is being said rather than on the form of the message. This could be referred to as the "Great Paradox of Language Teaching":Language is best taught when it is used to transmit messages, not when it is explicitly taught for conscious learning."(Krashen and Terrell,55)

READING AND WRITING SKILLS

Reading should be a part of the core course even for beginners. Reading is a form of communication, and early reading is essential since the reading skill reenforces the other skill areas. "Learning how to read and write, far from being a hindrance to speech, will act instead as strong reenforcement if it is done concurrently with-not before-or weeks or months later(than) learning how to speak,"(Diller, 1970, 21-22) Readings from the technical field to be studied can be chosen and edited according to the learners' ability. Low level readers would benefit from teacher-made texts covering both technical and everyday situations. Ideally the reading and writing exercises would be coordinated with the on-site component of the course. The chart given above as a sample science lab exercise can easily be made into a writing exercise as well. Similarly, completed lab reports or descriptions can be used as reading exercises.

THE NEED FOR AN "ON-SITE" COMPONENT

Research indicates that exposure to real discourse, where students actively participate, enhances learning because the intake or primary linguistic data used by the learners controls the operation of the language acquisition device. Krashen states,"An intensive (intake) informal environment can provide both the adult and the child with the necessary input for the operation of the language acquisition device."Krashen, 1976,167) An EST course with an "on site" component provides this input which differs from the "teacher talk" of the formal ESL classroom. An engineer explaining an auxiliary power supply transfer board will use real discourse in a natural setting, and the students will learn both content area and language. As they engage in question and answer sessions with the on-site personnel and accompanying ESL teachers they will have more opportunities for comprehensible input. This type of approach meets the criticism that most EST material is inauthentic: "That is, most language-teaching materials are only texts and not discourses that have communicative functions. Students are served a soup of texts awash in teacher talk." (Palmer,82) Contrived activities may offer a more controlled teaching situation, but they will not motivate the learners as much as a real situation in a science laboratory or at a site where the language is spoken naturally by experts in the field. Even if the ESL instructor has to rephrase some of the discourse for lower level learners, the exposure to natural language is invaluable, and the restatement of the message by the instructor provides more opportunities for

input and response by the learners who get instant feedback on what they have been studying. Language skills and content area merge together as the students spend an increasing amount of time attending demonstrations and on-site field trips.

These lectures demonstrations, science labs and other "live" material are phased in gradually over a period of time. At first, learners spend more time in the core class, but as their language skills increase more on-site discourse is added. A low level class would need a longer core course than a high intermediate, but the "live action" should start as soon as possible. A simple science demonstration in a laboratory can be useful even for beginners who need to develop listening comprehension.

FIGURE A: MODEL OF A "HANDS ON" APPROACH

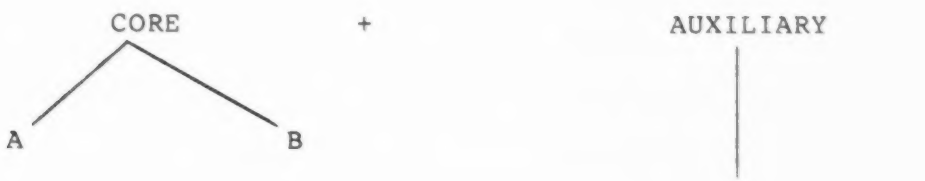
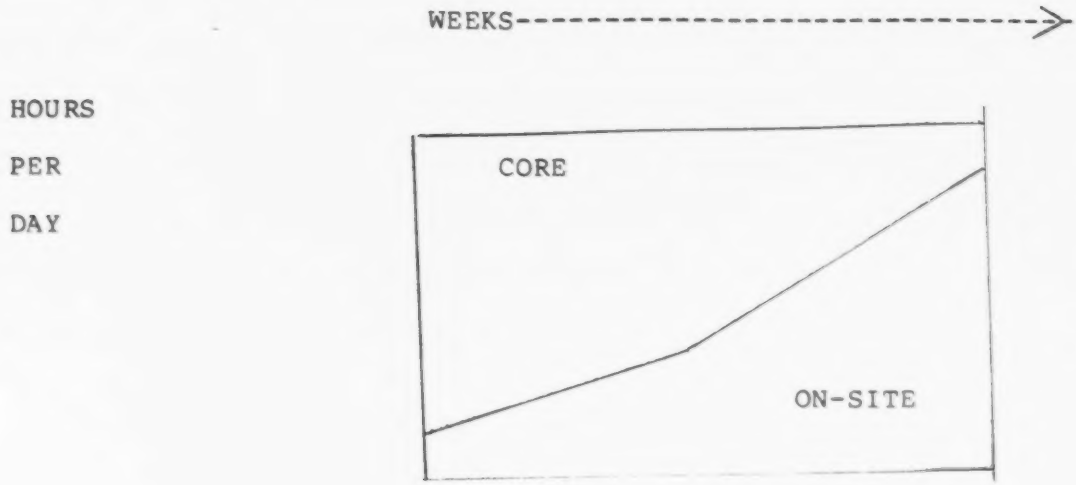


FIGURE B ON A TIME PROFICIENCY SCALE



Note how the time alloted for the live demonstrations increases as a function of time. Both the core course and the on-site component complement each other and help the learners build their language skills on what they know of both the target field and the English language. Each new topic is introduced in the total context of the course using a real situation. This type of approach is necessary to stimulate language learning: "Second language material must build on what students know and what arrouses their curiosity and interest at their age and in their circumstances if it is to be effectively integrated into stored experience." (Rivers and Melvin,164)

A PRACTICAL EXAMPLE

This "hands-on" approach to EST worked very well with a special group of Saudi Arabian students who came to the United States to study English for science and technology. Their English proficiency ranged from low to intermediate, therefore they had to start with a full-time (100%) core component of language skills and graded readings in their content area. For two weeks they worked on structure, reading, speaking and listening. All these skills were integrated to provde the learners with a functional language base. Since the proficiency level of the students was lower than expected, new material other than what was ordered had to be prepared for the classes. The students were knowledgeable in their content area,power supply; therefore, the ESL staff was able to build upon this base to compensate for the weaker than expected English skills.

After two weeks of intensive language instruction and content- area readings, the "on-site" component was phased in where the students studied emergency power supply. Local companies provided tours and demonstrations, and the engineering department, which co-sponsored the program, set up lectures and science lab workshops where the students actually buit a rectifier. One or two experienced ESL instructors accompanied the group on tours to help with explanations and to provide additional input in the form of teacher talk and wh-questions. The unique partnership between the ESL department, the engineering department and

the various companies resulted in a meaningful learning experience for the group.

In conclusion this unique "hands-on" approach helped the learners much more than just a series of ESL lessons and lectures. They were able to become directly involved in the target field while learning the target language. The new language became a real life experience rather than just a set of rules and a list of words.

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